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ym<sup>2</sup> **Research Briefs**

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**Nutrition and Health**

Twenty million living colon cells can now be isolated from a small stool sample using ordinary laboratory equipment. The new technique is noninvasive and can be done repeatedly, enabling researchers to study the effects of various diets on colon tissue over time. ARS researchers developed a chemical solution that protects the cells from breaking apart and provides sugar to keep them viable as the stool sample is homogenized, filtered and then spun in a centrifuge. Associates with Johns Hopkins University in Baltimore were able to distinguish precancerous cells from normal ones with a technique called flow cytometry, which uses antibodies that bind to specific proteins on the cells' surfaces. If validated in clinical tests, the technique for isolating colon cells also may allow physicians to diagnose early stages of colon cancer or gauge colon inflammation without touching the patient. Currently, patients must undergo colonoscopy—visual inspection and removal of colon tissue—which requires hospitalization and causes discomfort. The surgically removed cells come from limited areas, but those isolated from the stool are more useful because they represent the entire colon surface.

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Senior citizens who filled up on breakfast fare—milk, cereal and fruit—had the highest intakes of trace elements and the best nutritional status among 680 Boston area residents studied. Researchers analyzed 3-day diet records prepared by the volunteers for the foods that contributed the most calories in their diets. Of the four major eating patterns that emerged, a diet high in milk, cereal and fruit provided the best nutrition. This group was predominantly women. By contrast, a diet high in meat and potatoes was least nutritious. This group—which was predominantly men—had the lowest intakes of trace elements and the lowest blood levels of folate and vitamin B<sub>6</sub>. A third group that consumed a lot of bread and poultry had the lowest caloric intake among the four groups but, paradoxically, had the highest body mass. And the group of high alcohol consumers—mostly men—had the lowest blood levels of riboflavin and vitamin B<sub>12</sub>, but the highest levels of HDL cholesterol, the beneficial kind.

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Shift work may raise cholesterol levels in addition to upsetting people's gastrointestinal tracts and depriving them of sleep. That was the result of a study of rats subjected to variable light and dark cycles. The findings may help explain why shift workers seem to have more cardiovascular disease than day workers. At the end of 6 weeks, cholesterol was 24 percent higher in the group of rats subjected to changing light-dark cycles simulating 8-hour shift work. That compared to a control group on a constant light-dark cycle of 12 hours each. A third group of rats was subjected to a low-copper diet—a known elevator of cholesterol—along with the changing light-dark schedule. These animals had cholesterol levels 70 percent above the control group.

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Dried parsley flakes—sprinkled generously on main dishes and salads—could add small but significant amounts of several essential trace elements to your diet. The flakes are also a source of prospective elements such as molybdenum and boron. On a gram for gram basis, parsley

flakes had 2 to 3 times more copper, iron, magnesium, molybdenum and boron than any other food product among 52 items analyzed. And the flakes scored second in zinc and manganese. However, it takes a little more than 2 teaspoons of parsley flakes to make one gram because the water has been removed--which also concentrates the minerals. How well the minerals are absorbed from the flakes compared to other foods needs to be determined.

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**Moderate amounts of corn bran** in a well-balanced diet seems to have little effect on mineral absorption. Tests with pigs, which have digestive systems similar to humans, show that high dietary levels of corn bran bind calcium in the upper digestive system, making it unavailable to absorption. But when the pigs were on diets containing recommended amounts of both bran and calcium, the corn bran did not influence calcium absorption. Potassium and sodium absorption also were largely unaffected by the corn bran.

*National Center for Agricultural Utilization Research  
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**Some Houston infants will be eating their greens** in the form of specially grown algae. Researchers plan to use the alga, *Spirulina*, to see if infants can make certain amino acids on their own or whether the nutrients have to come from the diet—and, if so, at what age. In this alga, about 97 percent of the carbon atoms are the heavier, nonradioactive <sup>13</sup>C compared with 1 percent found in everything else on Earth. Using such a uniformly labeled food source is like attaching a video camera to each amino acid (or any other carbon-containing nutrient for that matter) and following its travels through the body—without any harm to the infant. Before using it in human studies, researchers fed the algae to a hen and found, to the surprise of chicken experts, that the amino acid proline was essential—at least under their experimental conditions. The researchers then fed it to several women and demonstrated, not surprisingly, that the volunteers synthesized more amino acids when they fasted. What's more, they were able to "see" how quickly the amino acids were absorbed from the algae and how quickly they became incorporated into a blood protein. The *Spirulina* was grown in a closed system with "heavy" carbon dioxide by a private company in Columbia, MD.

*Children's Nutrition Research Center, Houston, TX*

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**Food labeling** will benefit from a tannish powder representing the total American diet. Just as U.S. clocks are set to the National Institute of Standards and Technology master clock in Boulder, Colo., laboratories analyzing foods for nutrient content need a primary food standard against

which to check their values. The powder—officially known as Standard Reference Material (SRM) 1548—is certified by NIST for concentrations of 13 essential trace elements and values for fat, cholesterol, fiber, ash, calories and Kjeldahl nitrogen—a measure of protein content.

Researchers with ARS, NIST and the Food and Drug Administration developed the standard using foods from FDA's Total Diet Study. On sale since October 1990, SRM-1548 is a best seller despite its high cost—\$251 for less than half an ounce. It enables laboratories to ensure the accuracy of their analytical methods and validate secondary reference materials used in day-to-day quality control.

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## **Tomorrow's Foods**

**Six new fruits from Malaysian rain forests** are bound for U.S. markets within the next few years. Plants of manga air, bruas, medang, langsat, terap, and mata kuching are now growing in greenhouses at an ARS lab in Miami. The fruits offer U.S. consumers new flavors, aromas and textures. They are the most promising of more than 85 different fruit and nut crops brought back from a plant exploration trip last year. Regardless of the fate of their native rainforests, the plant material is alive and available for research and breeding. To save time in breeding, scientists use isozyme analysis, in which protein patterns serve as genetic markers that show if plants are closely or distantly related. In addition to saving valuable breeding time, this simple procedure also allows maximum variation in germplasm collections with limited space.

*Subtropical Horticulture Research Lab, Miami, FL*

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**A license to produce a low-fat milk concentrate** developed and patented by ARS scientists has been granted to a major manufacturer of infant formula. Mead-Johnson Nutritional Group of Evansville, Ind., is studying various uses of the concentrate, which has the texture of whole milk but the cholesterol content of skim milk. Past attempts to concentrate dry whole milk resulted in difficulties in reconstituting the butterfat. But, ARS scientists found that combining non-fat dry milk with a critical level of water, then blending cholesterol-free oil—such as soybean, corn or peanut oil—overcomes the need for emulsifiers and homogenizers to avoid oil separation. The concentrate, which can be frozen, occupies about 75 percent less storage space than fluid milk.

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**Dark crimson lettuce** may give tomorrow's salads a new look. Other options: unusual lettuces with yellow leaves, or blue leaves atop long stems eaten like celery. These surprising new colors, shapes and textures appeared in a test garden of nearly 400 kinds of lettuce planted by ARS scientists. Plant breeders can use these varieties to add unusual traits to the familiar iceberg, butterhead or loose-leaf lettuces. Seeds for the garden came from a permanent collection preserved by the researchers. To find other promising lettuces, researchers will plant new test gardens over the next several years.

*U.S. Agricultural Research Station, Salinas, CA  
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**A new rice variety that smells like popcorn** has been released for commercial production. Dellmont has the aromatic, popcorn scent of rice imported from the Far East, and the texture of traditional U.S. long grain rice. The grains separate after they are cooked, in contrast to most imported aromatic rices that tend to stick together. Dellmont also has several advantages over other domestically grown aromatic rices: higher yield, better milling quality, more resistance to rice blast disease and less likely to fall over in strong wind or rain. Researchers expect Dellmont to have an impact—both in domestic and export rice markets—once it is grown commercially over the next few years.

*Rice Research, Beaumont, TX  
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**All-weather plants** may be the payoff from the successful transfer of a gene from a warm-season crop—cucumbers—to the cool-season tobacco plant. The ultimate goal is to custom-design cotton and other farm crops so they yield more—even in the face of drought and daily or seasonal temperature extremes. The transferred gene codes for the “warm” version of NADH hydroxypyruvate reductase, an enzyme involved in plant stress. This resulted in a tobacco plant with an equal mix of the “warm” and “cool” versions of the enzyme. According to the theory proposed by ARS scientists and confirmed by tests on enzymes in plants, the enzymes have their own individual “thermostats” set by their species-specific gene sequence. Under this theory, the preferred temperature range for cucumber, is 81 to 101 degrees F, while for tobacco it is 66 to 82. Altered tobacco plants have a combined range for the activity of the composite enzymes of 66 to 101 degrees F. So in terms of temperature, the hydroxypyruvate enzyme in the offspring behave like cucumber during the heat of day and tobacco in the cool of night.

*Plant Stress and Water Conservation Research, Lubbock, TX  
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**Miniature iceberg lettuces** developed by ARS may soon be growing in backyard gardens in the Eastern United States, where larger icebergs have been difficult to grow.

In preliminary tests with collaborators in New York and Pennsylvania, the heads didn't bolt—that is, put on a sudden spurt of growth and send up a flowering stalk through the lettuce head just before the crop is ready to harvest. This is what typically happens to iceberg lettuce, especially the choice Western types, when grown in the East. One mini-lettuce variety tested is the familiar green; another has green leaves with an attractive red tinge along leaf edges. The heads ranged from tennis ball to softball size and the leaves had a mild to strong flavor. If flavor questions are resolved in next season's tests, seed packets could be on the market by 1993.

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## **Food Freshness and Safety**

**A plant mulch**, hairy vetch, increased tomato yields by about 138 percent and reduced insect infestation to a minimum. Tomato plants growing in vetch plots were greener and bigger than plants in plots where plastic, paper and no mulches were used. Field tests showed that, unlike plastic, the vetch mulch adds organic matter to the soil and increases water-holding capacity. Also, the vetch adds nitrogen, reducing the amount of fertilizer needed. And, the mulch suppresses early-season weeds, eliminating the need for herbicides before planting. Since the mulch repels the Colorado potato beetle—a major pest of tomatoes during the first month after field planting—decreased amounts of pesticides are needed. ARS scientists plan to test hairy vetch on other vegetable crops.

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Weed Science Lab, Beltsville, MD  
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**Chances of lead poisoning** from eating vegetables grown in contaminated soil can be reduced by adding composted sewage sludge to the soil. A study of soils from gardens in Baltimore, Md., showed that the sludge “binds” lead and prevents its absorption by plants. Lead levels in lettuce leaves were reduced by as much as 64 percent. Levels in spinach leaves declined by over 50 percent. Several of the soils studied had lead levels of 1,000 to 5,000 or more parts per million (ppm). The Environmental Protection Agency considers soil with more than 500 ppm to be hazardous waste.

*Soil-Microbial Systems Laboratory, Beltsville, MD  
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**Soggy sandwiches or pizzas** may someday become just a bad memory. In ARS tests, a colorless film, which is potentially edible, formed a moisture barrier between filling and bread that kept the latter dry for 2 days. It could

protect pie crusts, layers of filled cakes, or other foods, too. The finished film won't interfere with food flavors, scientists report. The films are made from chitosan—an extract from finely ground shells of crustaceans—and other ingredients. The compounds must be approved for food use before the film can be sold for home or commercial kitchens. Other scientists earlier proposed the idea of using the ingredients for making films. But the ARS team is apparently the first to extensively test the film's effectiveness as a water barrier.

*Western Regional Research Center, Albany, CA  
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**A yeast that occurs naturally on citrus rinds** can prevent fruit rots that claim about 25 percent of the fruit harvested worldwide. ARS and Israeli researchers have co-patented three new strains of the yeast *Pichia guilliermondii*, which can be cultured easily in fermentation tanks. It has been found effective against several fruit rotting organisms that strike a number of fruits after harvest. Among them are grapes, apples, pears, tomatoes, persimmons, grapefruit, oranges and lemons. Fruit treated with this yeast don't need fungicidal treatments against several fruit-rot pathogens. Yeast strains can be applied by dipping, spraying or brushing—and can be incorporated into waxes, wraps or other protective coatings. Application can be made before or after harvest. But the preferred time is after harvest and prior to storage and shipment.

*Appalachian Fruit Research Station, Kearneysville, WV  
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**Subjecting mature green tomatoes to heat** delays ripening and softening. Such results are contrary to the established practice of storing green tomatoes at temperatures between 57 and 60 degrees F to retard the ripening process. ARS scientists put the green tomatoes in storage at about 104 degrees F for four days. Then the fruit was stored at room temperature of about 70 degrees F. After 10 days, treated tomatoes were still firm, just beginning to ripen with a slight red color. Untreated fruit were blood red and completely ripe so that they were susceptible to bruising and decay. By delaying fruit softening, the new heat treatment could cut tomato losses during shipping and lengthen shelf life in stores.

*U.S. Horticultural Research Lab, Orlando, FL  
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**A coating that extends shelf life** of fruits and vegetables has been found to kill Caribbean fruit flies in grapefruits, mangoes and carambolas. Such fruits are hosts to the pest in Florida and must be treated before they can be shipped out of the state. All the ingredients in the original coating were found in laboratory analyses to be safe for humans to eat. Different formulations of the coating are being studied to determine which works best at killing fruit flies when applied on the outside of fruits. Scientists are combining

the coating with other quarantine treatments such as hot air, cold storage and methyl bromide fumigation to see which combinations are the most effective. Scientists at the ARS Winter Haven lab originally developed the coating to lengthen shelf life of produce and filed for a patent. A Florida company has received a license to use the coating as a quarantine treatment.

*Subtropical Horticultural Research Lab, Miami, FL  
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**A tiny but aggressive wasp** makes mince meat out of immature sweetpotato whiteflies. ARS scientists, who discovered the wasp (*Encarsia formosa*) in Beltsville, Md., have been studying it for 2 years. As small as a fleck of dirt, the wasp is only parasitic in its larval stages, destroying its whitefly host as it develops. Once the adult wasp lands on a whitefly-infested leaf, she makes a beeline to a whitefly and lays her eggs inside the pest's body. In about 15 days, new adults eat their way out of the dead whitefly's body. How efficiently the wasp attacks whiteflies depends in part on the interaction between the pest and its host plant. The scientists are now working to discover how the wasp finds and homes in on its host. Once they know the mechanism, they will be better able to use wasps as biocontrols. Based on the success of this research, USDA's Animal and Plant Health Inspection Service will start mass rearing wasps at a facility in Mission, TX. From there, wasps will be sent to at least six locations for testing. ARS, APHIS, several universities and private industry are cooperating on the project.

*Florist and Nursery Crops Laboratory, Beltsville, MD  
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**New tomatoes from ARS** stay on the vine but don't ripen until desired. This could lead to fresher tomatoes at the supermarket year-round. The new fruit, genetically engineered by researchers, could also reduce spoilage and refrigeration costs that get passed to consumers. The researchers say the approach looks promising for many highly perishable fruits and vegetables, as well as for cut flowers. Scientists engineered the tomatoes to block production of ethylene, a compound that causes ripening. Later, when exposed to ethylene, the tomatoes ripened and softened, taking on the texture, color and firmness of a vine-ripened crop.

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